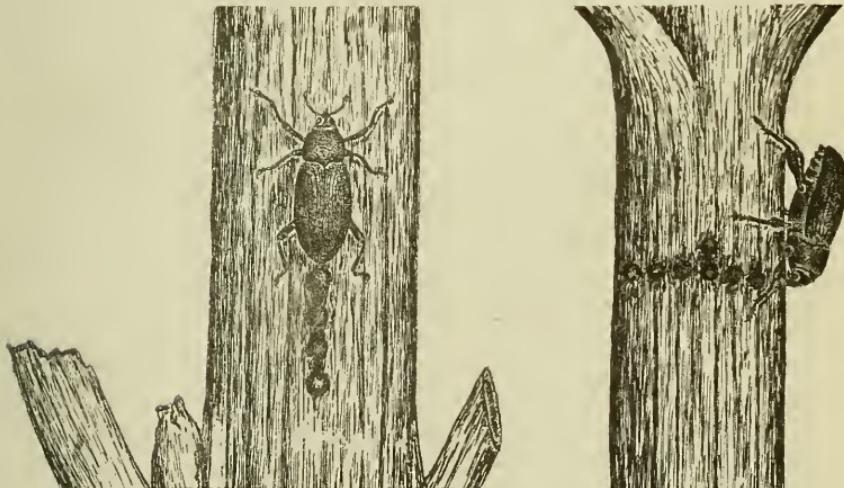


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The Grapecane Gall-Maker and the Grapecane Girdler.



BY FRED E. BROOKS.

[The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address Director of Agricultural Experiment Station, Morgantown, W. Va.]

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The Grapecane Gall-Maker and the Grapecane Girdler.

INTRODUCTION.

We have in West Virginia two species of little snout-beetles that injure grapevines by attacking the new canes soon after growth begins in the spring. They are the grapecane gall-maker, *Ampeloglypter sesostris* Lec. and the grapecane girdler, *Ampeloglypter ater* Lec. As their generic name indicates, the two species are nearly related. So far as size and shape are concerned, the differences are scarcely discernible, but in color the gall-maker is dark brown, while the girdler is shining black. Their methods of attacking the vine are also distinct. The gall-maker, in providing a place to deposit its egg, makes a wound in the cane which develops later into a gall-like swelling, whereas the girdler, in its egg-laying operation, cuts off the tip and otherwise mutilates the end of the young cane.

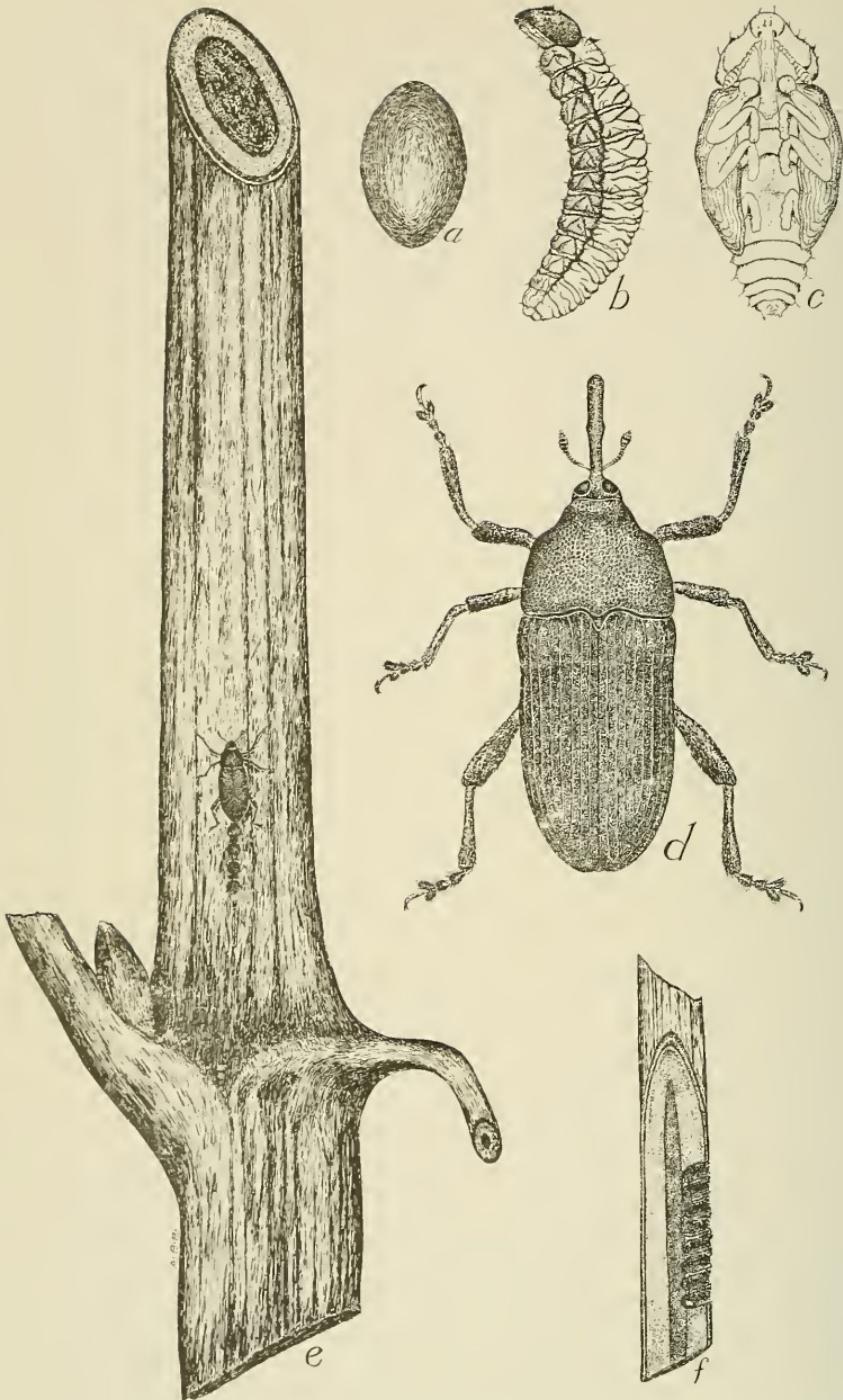
Both insects vary greatly as to their abundance in different seasons. For a year or two the characteristic marks of one or both species will be very conspicuous on the vines, and then for a period of a few years following they may be almost entirely absent. This irregularity in their occurrence is due largely to the fact that when the beetles increase in numbers there follows a corresponding increase in the numbers of their natural enemies. These enemies, which are chiefly parasitic insects, attack the beetles in their immature stages and sometimes reduce them almost to the point of extermination. When there comes a decrease in the parasites the beetles begin to multiply, but since the females of neither species produce many eggs it takes them some time to recover from the set-back.

Very little preference is shown by either insect for any par-

ticular species or variety of grape. I have found the evidences of their work on about twenty varieties of cultivated grapes and on the three wild sorts that are commonly found in the woods and grown-up fields of the northern and central portions of this state. These wild sorts are the northern fox grape, *Vitis labrusca*, the "hill-grape" or "frost-grape," *Vitis aestivalis*, and the "chicken grape," or "pigeon grape," *Vitis cordifolia*. Both the gall-maker and the girdler are undoubtedly natives of this country and must have confined their attacks originally to wild grapes and kindred plants.



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The Grapecane Gall-maker. a, egg; b, larva; c, pupa; d, adult; e, beetle making the wound in the cane that contains the egg and later causes the gall to form; f, transverse section of wound showing egg in lower chamber. All except "f" greatly enlarged. Drawings by A. B. Brooks.

The Grapecane Gall-Maker.

Ampeloglypter sesostris Lec.

Order Coleoptera; family Curculionidae

HISTORY AND DISTRIBUTION.

About ten years ago this insect was made the subject of an investigation in Ohio, conducted by F. M. Webster, and the results were published as Bulletin 116 of the Ohio Experiment Station. The bulletin gives the more essential facts in regard to the gall-maker and its habits, but since the publication of that paper a few additional points relative to the species have been observed in West Virginia. These observations, together with those already published, give us a fairly complete knowledge of the insect as it occurs in this section of the United States. Webster collected galls from grapecanes in June and kept them until the larvae which inhabited them transformed to beetles in August and September, thus showing that the adult stage is reached in late summer instead of in the spring, as had been supposed previously. I was unable to duplicate this breeding work satisfactorily on account of the extent to which my specimens were parasitized. On the other hand, I watched the female on several occasions while she was engaged in egg-laying, an operation which I believe has not been described heretofore. Most of my observations on this species were made at French creek, W. Va., in the summer of 1905, where, at that time, the beetles were very abundant. Since 1905 but few specimens have been seen in that locality and examples of their work have been correspondingly scarce.

The species was described by LeConte in 1876, from speci-

mens collected in Missouri. Since that time it has been reported from Minnesota, Ohio, Pennsylvania and other eastern, south-eastern and mid-western states.

THE ADULT INSECT.

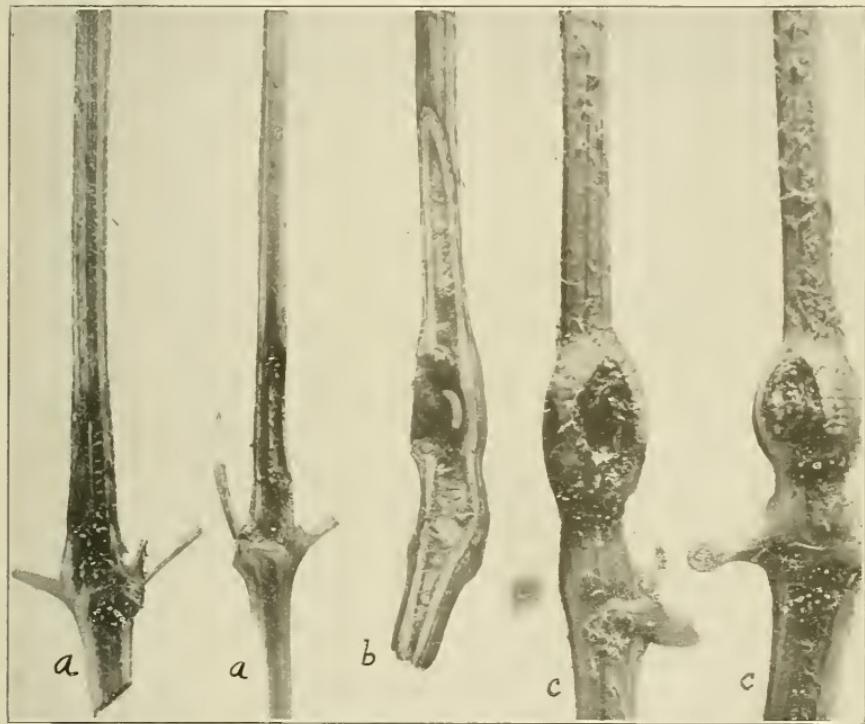
The gall-maker in its adult stage is a reddish-brown beetle which measures about one-eighth of an inch in length and one-twentieth of an inch in width. It has a curved snout, one-third as long as the body, which it carries projecting forward and downward. The thorax and head are finely and densely punctured and the wing-covers are furrowed longitudinally. The beetles appear on grapevines during the month of May and are present for several weeks. They are so small, however, that they rarely attract attention. Soon after their appearance the females begin to oviposit in the young canes, and after the eggs are laid the parent beetles of both sexes disappear in late June or July.

The beetles feed sparingly on the vine and in doing so make little pits in the young tendrils, in the buds and bark on new canes and in the mid-ribs on the underside of leaves. It is probable also that the female swallows some of the tissue which she tears from the cane in making her egg-chamber. The injury which results from the pits eaten in the plant is insignificant, but the manner of feeding is otherwise of some interest, since it indicates that the beetles may be killed with arsenical sprays.

The beetles are active only during warm days. In cool or rainy weather and at night they hide beneath the strips of bark adhering to old canes, or remain motionless on the underside of the leaves.

APPEARANCE OF INJURED VINES.

The injury done to the vines by this insect is in the shape of gall-like growths that begin to develop on the new canes early in the summer. These galls are abrupt swellings of the



Photographs showing injury done by the Grapecane Gall-maker.
a, a, newly made wounds; b, larva feeding in the cane and the gall
beginning to form; c, e, fully developed gall's. Natural size.

cane to something like twice its normal diameter, the enlargements being an inch or an inch and a half in length. The swelling is about uniform around the cane except that on one side there is a deep longitudinal scar from a half to three-fourths of an inch in length. This scar comes from a wound made by the female beetle in preparing a place to lay her egg. The gall is almost invariably located just above a joint of the cane. I examined several hundred of the galls and found only one in which the lower end was as much as an inch above a joint. The one exception was that of a gall located three-fourths of an inch below a joint. The cane on which this gall was found was being trained in a horizontal position and the gall occurred just below instead of just above the joint, evidently through an error on the part of the beetle that made the wound which caused the gall to form. Occasionally a single cane will bear four or five galls, and on one cane I found nine. Strange to say, the female nearly always selects the joints of the young cane beyond the last or outer bunch of fruit for her points of attack. Consequently, if an infested cane is bearing a bunch of fruit at each of the three joints nearest its base the galls will not appear at these joints, but the first one will be found not nearer to the base of the cane than just above the fourth joint. In several cases where canes were bearing but two bunches of fruit, galls were found at the third joint. This peculiarity was noticed so often that there seems little doubt that the female rejects the fruiting joints as being unsuitable places for her eggs to be deposited. Just why she should discriminate against the fruiting joints is not very clear.

The swelling of the cane at the point of injury begins soon after the wound is made, but the gall does not reach full size until six or eight weeks later. On vines of varieties that produce dark-colored fruit the bark and wood about the wound soon takes on a reddish-purple color. This discoloration does not occur on varieties that bear white or green fruit.

The presence of the galls appear to have but little effect on the growth and vigor of the cane. Occasionally a cane that has

no support will be broken by the wind or by its weight of leaves at the point of injury. In tying up the canes after pruning in the spring they will sometimes break more readily at the galls than elsewhere. In pruning vines affected with the galls this should be borne in mind and the canes on which no galls are found should, when possible, be preserved for fruiting.

THE EGG AND HOW IT IS DEPOSITED.

The egg is oblong-oval in shape, .016 inch wide and .025 inch long. In color it is yellowish-white and the surface is smooth. It was found to hatch in from seven to ten days, but the exact period was not noted.

The scar which has been mentioned as occurring on the side of the gall is the result of a slit, or rather of a row of closely connected holes which the female makes for the reception of a single egg. The making of this wound and the subsequent feeding of the larva which hatches from the egg placed within it constitute practically all the injury which the species does the vine.

The female often spends several hours in the elaborate operation that attends the laying of a single egg. The work is carried out with so much show of design in every movement that it may be worth describing in detail. The case taken is that of a female that was observed on May twenty-third, 1905. After crawling about over a young cane for some time she took a position about half an inch above a joint, with her head directed toward the tip of the cane. With her snout she then bored a small, ragged hole to the heart of the cane. At the entrance the hole was about one-twentieth of an inch in diameter, but at the inner end it was somewhat larger. When the hole was completed the beetle turned about and applied the tip of her abdomen to the opening and deposited an egg, attaching it to the wall of the hole at the inner extremity. She then resumed her former position and moved up the cane a distance about equal to the diameter of the hole. The snout was then extended forward

as far as possible and the end pressed against the bark and then drawn downward to the margin of the hole, which was directly under the head of the insect. By approaching slowly and moving with care I was able without disturbing her to watch every movement of the beetle through a hand lens. By this means I could distinctly see after each scraping movement some hair-like fragments of the bark held between the jaws at the end of the snout. These fibers of bark were thrust into the hole and the scraping continued without rest until the hole was packed full and quite a groove had been made in the bark by the removal of the fragments.

When the hole had been filled to her satisfaction she began a second hole at the upper end of the groove made in gathering material to plug the first. This hole was completed with the same care as the other, and when it was done the beetle turned and applied the tip of her abdomen to the entrance just as though she were about to lay another egg. Instead of an egg, however, she deposited only a minute drop of clear liquid and then proceeded to fill the hole in the same manner in which she had filled the one containing the egg. The work of making the holes, excreting the liquid into each and then filling them with fiber was continued until the row contained eight holes. After the completion of the eighth hole the insect crawled away. The time spent in making and filling the last hole was a little less than that expended on the first.

I afterward found that eight holes was hardly an average number for a wound. One wound was found that consisted of fourteen holes, and several others were noticed that contained twelve or thirteen. The time occupied by four individuals which were watched during their egg-laying operations averaged for each thirty-one minutes in preparing the first chamber, three minutes in laying the egg, twenty-four minutes in filling egg-chamber and making next hole, one minute in excreting liquid, twenty-one minutes in filling hole and making next, with about the same ratio of decrease in the time spent on each hole until the series was finished.

Most of the eggs are produced between May fifteenth and June fifteenth, though I have seen a few wounds that were made after the latter date. A beetle will lay two eggs in a day, in rare instances three, and possibly four may be produced. It is doubtful if one individual ever lays more than twenty-five to forty eggs.

OTHER STAGES OF THE INSECT.

The larva is a footless grub about two-fifths of an inch in length. Its color is yellowish-white with a light brown head and dark brown jaws. It feeds, first, in the mutilated wood about the egg-chamber, and later works its way along the heart of the cane, either above or below the gall. It reaches full growth in from eight to ten weeks and then changes to a pupa within its burrow. The pupae which I found were situated at the point where the burrow penetrated the joint just below the gall.

Webster found all stages of the insect in the galls on August eleventh, with some of the adults making their way out. I found both larvae and pupae on August tenth, but could find no adults. The pupa stage is evidently of short duration, as Webster found that in September nearly all the insects had transformed to beetles and had left the galls. The beetles, according to Webster, hide away for the winter in fallen leaves or matted grass, and emerge from hibernation the next spring to oviposit in the new canes.

NATURAL ENEMIES.

Webster called attention to the fact that the wound made by the female in the cane does not heal, but remains open so that the young insect on attaining the beetle stage has a ready exit by which it may quit the gall. While the opening allows the gall-maker to escape from its burrow in the cane it is otherwise of great disadvantage to the larva, since it admits parasites of several kinds which prey upon it. Webster found two species

of parasites attacking the gall-maker; a Tachina fly, *Myiophasia aenca* Wied. and an hymenopterous parasite, *Neocatolaccus tylodermae* Ashm. As has been stated, the specimens which I observed were very badly parasitized. On July tenth I examined forty-five galls. Eight of these contained larvae of the gall-maker, thirteen were empty and twenty-four contained the larvae or pupae of parasites which had killed the gall-maker. Another examination of fifty galls on August tenth showed even a greater mortality of the gall-maker as a result of parasite attacks. The parasites which I reared were all hymenopterous species. I have not been able to obtain the specific names of these species, the most abundant, however, was a Chalcis fly, *Eurytoma* sp., as determined by Mr. J. C. Crawford, of the National Museum.

PREVENTIVE MEASURES.

The gall-maker may be destroyed by cutting out and burning the canes on which the galls occur during the months of July and August. The habit which the female has of depositing her eggs at the joints above the terminal bunches of fruit makes it possible to practice this method without destroying any of the crop. Webster recommends collecting and burning the fallen leaves and other rubbish in the vicinity of vineyards during the fall and winter in order to destroy the hibernating beetles.

Since the beetles take most of their food from the exposed portions of the vine, there is little doubt that they may be killed by spraying with Paris green or arsenate of lead. The spraying for the gall-maker will also be effective against the grape curculio, the grape berry-moth and several species of insects that attack grape foliage. The poison may very conveniently be combined with Bordeaux mixture, thus making the spray a preventive of the several fungous diseases of the grape, as well as a destroyer of the insect enemies.

The Grapecane Girdler.

Ampeloglypter ater LeConte.

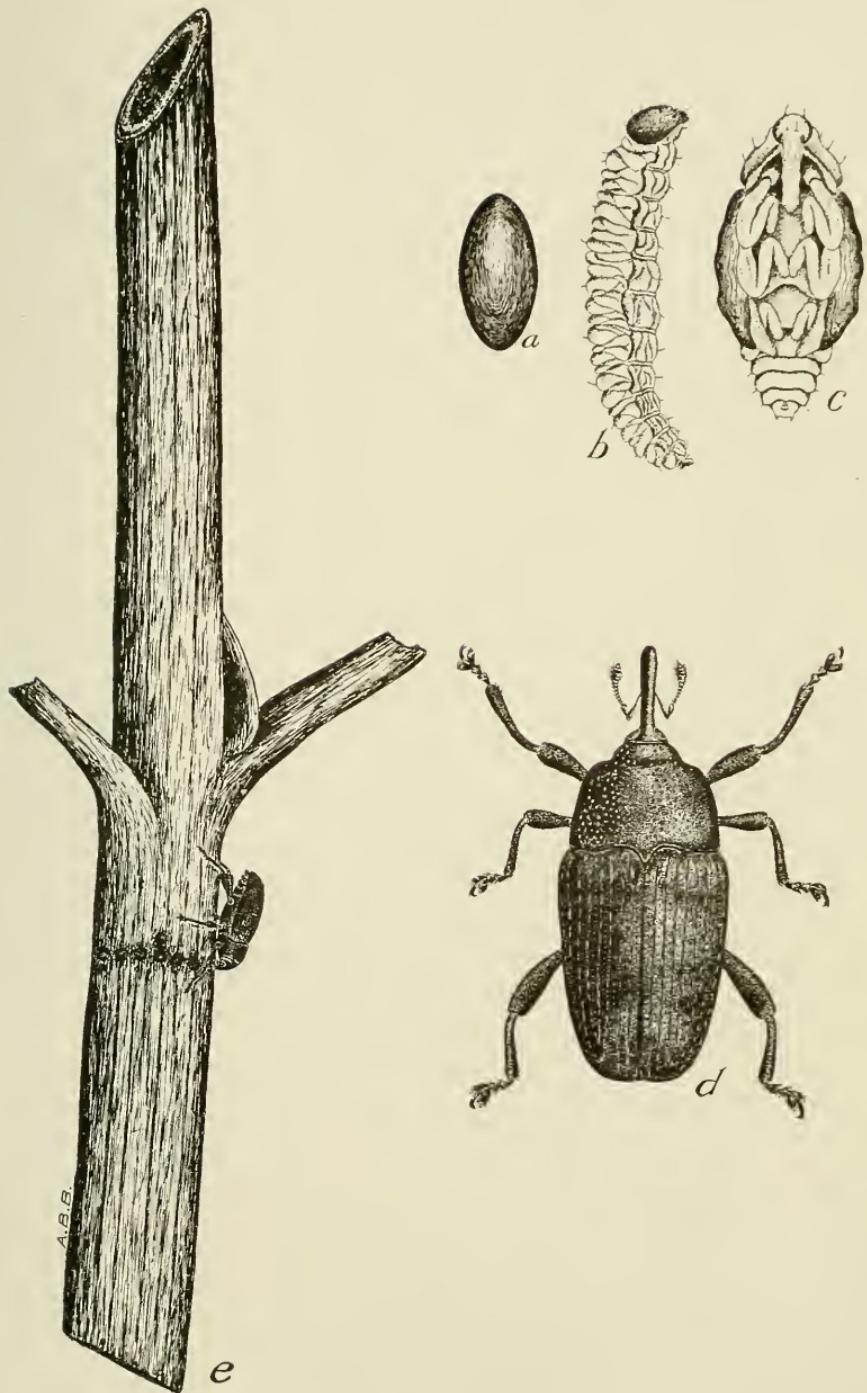
Order Coleoptera; family Curculionidae.

HISTORY AND DISTRIBUTION.

This insect is not often mentioned in entomological literature, probably for the reason that in the past it seems to have confined its attacks chiefly to the plant known as Virginia Creeper or Five-leaved Ivy, *Ampelopsis quinquefolia*, and has seemed, therefore, of but little economic importance. In this state it appears now to have developed a preference for the grape. In several localities I have seen grapevines presenting a ragged appearance on account of the dead tips resulting from the insect's attacks, but I have never been able to find either the beetle or evidences of its work on *Ampelopsis*.

The species cannot now be regarded as a pest of very serious consequence, except in rare instances, but, as it has several times attracted attention as an enemy of the grape in this state during recent years, and as heretofore but little has been known in regard to its habits, it seems worth while to publish the following notes.

The distribution of the species seems to be quite general throughout the eastern and mid-western sections of the U. S. In 1862 Mr. C. V. Riley, in his First Report on the Noxious Insects of Missouri, mentioned it as forming galls on the common creeper. At about the same time Mr. Benj. D. Walsh had specimens of the insect in his collection in Illinois, marked "*Madarus ampelopsis*." It was not until the year 1876 that a description of the beetle was published. In that year Dr. John



The Grapecane Girdler. a, egg; b, larva; c, pupa; d, adult; e, beetle girdling the cane just below its egg-chamber. The upper one of the twin holes in the center of the cane contains the egg. All greatly enlarged. Drawings by A. B. Brooks.

L. LeConte described it in his work on the Rhynchophora of America, and gave to it the name which it still bears. Le Conte gives its geographical distribution as "Southern and Western States." Since the description was published the species has received but infrequent and brief notice, but has been recorded as occurring in several states from Missouri to Pennsylvania.

It seems a little strange that in nearly every case where it has been mentioned it has been referred to as a gall-maker on Ampelopsis. As already stated, I have not found it on Ampelopsis in West Virginia, although this plant grows profusely in the localities where the insect has been observed in greatest abundance. Ampelopsis is nearly related to the grape, however, and if this insect has now given up a once favorite food for another which it finds more to its liking the case is by no means unique in the history of insect behavior. In 1895 Dr. F. H. Chittenden remarked (*Insect Life*, Vol. VII, p. 387:) "Species which are known to affect Ampelopsis and other genera of the vine family will be found in time on the grape. Of such is *Ampeloglypter ater*." It now seems that this prediction has come true, even to the extent of the old food plant being abandoned, temporarily at least. The appellation "gall-maker" does not apply to the species as I have found it affecting the grape. The term "girdler," however, is entirely applicable. When the female lays her egg she carries out an elaborate program, one act of which is to girdle the cane below the point where the egg is inserted. The proceeding is an interesting one and is described in detail further along in this publication.

APPEARANCE AND HABITS OF THE BEETLE.

As has already been stated, the beetles of this species resemble those of the gall-maker, except that in color they are black. The length is the same (one-eighth of an inch) and the general shape is similar. The taper at the hind end of the wing covers is a little more abrupt and the prothorax is less densely punctured and more suddenly rounded in front. The beak is

about the same length, but is stouter and more curved. This species, like the other, appears on the grapevines in the spring just before the blossoming season. Egg-laying continues for about a month. The first eggs discovered were deposited on May thirteenth and the last on June tenth. No beetles were seen before May thirteenth, though they were probably abroad a few days in advance of that date. Several specimens were seen after June tenth moving about or feeding on the vines, but the last of this generation soon disappeared. But one generation is produced annually.

The wound which the beetle makes in ovipositing causes the tip and terminal leaves on the young cane to drop over and die, and shortly afterward to fall from the vine. The egg is not carried to the ground with the prunings when they fall, but it remains in the vine, and the larva which develops therefrom feeds in the heart of the stump from which the leaves and tip were removed.

THE EGG.

The egg is dingy-white in color, oblong, elliptical in shape, .030 inch long and .014 inch wide. An egg laid on May nineteenth hatched on May twenty-ninth. Other examples observed showed the period of incubation to be nine or ten days.

HOW THE EGG IS LAID.

During my observations of this insect I several times came upon the female just as she was putting the finishing touches on one of her egg-laying operations, but it was some time before I learned the sequence in which the different parts of the work were performed. Finally, on May twenty-first, 1908, I had the opportunity of watching the procedure throughout. The female observed was first seen at 12:40 p. m., just as she settled down and began working near the tip of a young Moore's Diamond grapecane. Her position was about half an inch below a leaf-

joint, and as she worked her head was directed downward, or toward the base of the cane. She first drilled with her snout a hole that extended through the bark and for a short distance into the soft wood beneath. After spending thirty-one minutes in making the hole she turned about and pressed the posterior extremity of her abdomen into the opening and deposited an egg. She then resumed her former position and began filling the hole over the egg with threads of bark torn from the cane immediately below the opening. In ten minutes the hole was filled and the beetle moved an eighth of an inch below and made a second hole which was similar to the first except that the latter extended only through the bark. When the hole was finished she applied the tip of the abdomen to the entrance, just as before, but laid no egg, nor could I determine that any deposit of liquid or other matter was left, as in the case of the gall-maker when it performs a similar act.

This second hole was not filled, but after the anal extremity was withdrawn the beetle turned about, moved a tenth of an inch to the left and made another hole. Again the tip of the abdomen was inserted and then withdrawn, after which another hole was made to the left at about the same distance as before. After making the third hole the beetle moved to the opposite end of the line and added two more and then returned to the left end and continued to drill until ten holes were in the row. The tenth hole completed the ring, which now extended in a regular line around the cane. The tip of the abdomen was inserted in all, but no eggs were laid in the holes composing the girdle. During the excavation of all the holes the beetle worked with her head directed downward, or away from the tip of the cane.

When the girdle was completed the beetle spent several minutes in going from one to another of the holes and inserting her beak into each as though to make sure that everything had been done properly. She then rested for two minutes, after which she crawled to the first joint above and ascended the stem of a leaf that grew from that point. Half way up the stem she began another puncture, this time working with her head up-

ward. The stem leaned considerably from the perpendicular, and this first puncture was made on the underside of the stem, but slightly to one side of the line of inclination. This puncture was followed by others, made close together and in a transverse line, until the row extended entirely around the stem except that the ends of the row did not meet by about the twentieth of an inch on the under side. These punctures were made so near together that their margins met and the stem was severed above so that it broke over and hung only by the thread of bark beneath that separated the holes on the opposite ends of the girdle. The beetle then crawled down the stump of the leaf-stem and up the cane to a point just below the second joint above the place where she had girdled the cane. Here she made another incision, in every way similar to that made on the leaf-stem. When completed the tip of the cane broke over at that point and hung by the thread of bark that had been left on the underside. The beetle then crawled about inspecting, first the cut made in the leaf-stem, then the girdle near the place where the egg was deposited, and then went back to have a look at the last cut which she had made in the cane. Seeming satisfied with her work she then left the place by crawling down the cane. At a joint some distance below she stopped and began feeding from a bud, when I placed her in a collecting bottle.

The operation lasted for three hours and forty minutes, and there were only two minutes of the time during which the beetle was not actively at work. I have seen girdled tips where two or three leaf-stems, and in some cases tendrils and bunches of fruit, had been cut. In such cases the time required for completing the operation must have been longer than in the one described.

A few points observed in this and subsequent egg-laying operations of the same species may be of interest to those who like to study the motives and meaning of the more or less intelligent acts of insects. The plugging of the hole in which the egg is placed is evidently done to exclude enemies. In two cases I removed the plugs soon after oviposition took place and

the next day the eggs were found and devoured by minute mites which occurred rather abundantly on the canes. The invariable practice of the female of working during the excavation and filling of her egg-chamber and of drilling the holes for the girdle below with her head directed downward, and then of reversing this position when she comes to pruning off the tips may also be accounted for. In working with her head pointing toward the ground the weight of the body is above and she can easily bring more pressure to bear with her snout, which facilitates the work of drilling. In doing the pruning, we may suppose that she reverses ends that she may retain a stationary foothold and avoid the possibility of falling with the pruned-off end.

In one case I saw a beetle cut off a tip that was held in place by one of its tendrils being coiled around a near-by cane. When the severed tip failed to drop she crawled back and forth over the cane for some time, both above and below the cut which she had made. She went twice to the extreme end of the cane and examined thoroughly a young leaf that grew there, but returned each time to the cut, and once did a little additional excavating with her snout, but did not sever the thread of bark on the underside. At last she crawled out the tendril to where it was wrapped about the other cane, and then turned and retraced her way to near the base of the tendril, where in two places she ate it about half off, but not sufficiently to permit it to part. After this was done she quit the place and moved away down the cane. The unusual action of the insect after the severed tip failed to fall almost persuaded me that she actually discovered that the tendril was obstructing the working out of her plan and that she attempted to remove the obstruction by cutting it off. However, on other occasions I saw beetles feeding on the tendrils and it is possible that in this case the insect considered her work done and in her seeming agitation was only looking for a suitable place to satisfy her hunger.

I saw another female make two of her characteristic incisions in pruning a cane but she did not continue the cutting in either quite to the point where the severed ends fell over. A.

passing breeze a few minutes later broke both, but, before they fell, the insect had completed her task and left. This observation also indicated that the failure of a severed part to drop might not be expected to bother the insect very seriously.

Another interesting case was observed in which two tips crossed each other. Just below the point of intersection an egg had been laid in one of the canes and a girdle made in the usual manner. The beetle had then moved on to complete the operation, but, at the point where the two canes met, she had accidentally taken the wrong cane. From this she had cut a leaf and the tip. In another case the female in making her girdle below the egg-chamber carried the line of holes around the cane obliquely, so that the ends did not meet by about a fourth of an inch. She continued adding holes to the line until it reached nearly around the cane the second time and then gave it up.

It is interesting to compare the methods of this insect with those of other species that girdle twigs or small branches in order to kill or partly kill the wood in which their eggs are laid and their larvae are to feed.

The "hickory twig-girdler," *Oncideres cingulata*, a "long-horned" beetle, lays its eggs in the branches of hickory and other trees and then girdles the branch below, by cutting a deep groove with its strong jaws so that the branch above dies and is frequently broken off by the wind. The "elm twig-girdler," *Oberea ulmicola*, a beetle of the same family, attacks elm in a similar manner. The female cuts a deep groove around a twig so that it is easily broken off by the wind. Below the groove she cuts a slit in the bark and deposits an egg and then moves further down the twig and girdles it a second time, now merely cutting through the bark so as to deaden the part above. Another species of the same genus, known as the "blackberry cane-girdler," *Oberea bimaculata*, cuts a double girdle and lays an egg between the two, in a similar manner, in the young canes of blackberry and raspberry. Still another "long-horned" beetle, the "oak-pruner," *Elaphidion villosum*, lays its eggs in the



Photographs showing tips of canes pruned by the Grapecane Girdler. The photograph above was made within ten minutes after the injury was done. In this picture the girdle is faintly distinguishable just below the joint where the leaf stem has been severed.

branches of oak and other trees but leaves the girdling to be done by its larvae. In this case the larva feeds in the heart of the twig until it is nearly full grown and then cuts the twig almost off at the lower end of its burrow. Immediately after the cut is made it retreats into the burrow above and waits for the wind to blow the twig to the ground, where it completes its transformation within the burrow.

The adult of the "raspberry cane-maggot," a two-winged fly of the genus *Phorbia*, lays its eggs near the tips of young raspberry shoots. The larva which hatches enters the cane and after working its way downward for several inches it encircles the shoot several times, with a spiral groove made just beneath the bark, which kills the shoot above, and the larva feeds thereafter on the dead wood. The "current stem-girdler," *Janus intiger*, a saw-fly, punctures the bark of current bushes near the ends of growing tips with its saw-like ovipositor and lays an egg in the orifice. Just above the egg, it girdles the twig by making several deep cuts with its ovipositor so that the twig breaks over. The larva which develops from the egg feeds on the pith of the stump.

There are other species that operate in a similar manner, but the ones that have been mentioned will serve to show that the peculiar habit, in one form or another, is shared by insects belonging to widely separated groups. It is interesting that so many species, which in most respects do not resemble each other in the least and which represent at least three orders, have adopted some form of this peculiar way of providing for the safety and comfort of their progeny.

THE LARVA AND HOW IT AFFECTS THE CANE

The larva is a footless grub about one-fourth of an inch in length. Like the larva of the gall-maker, it is white with a light-brown head. It feeds in the heart of the cane, eating out a burrow that extends only between the two joints on either side of the place where the egg is laid. The larval stage covers

a period of something over a month. In one case I got an exact record of its duration which was thirty-four days.

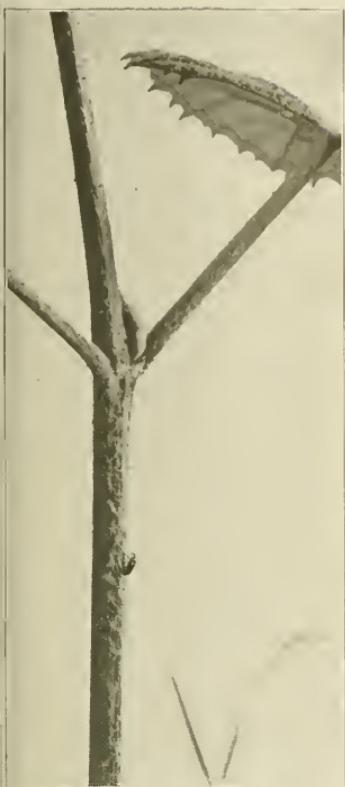
The cane in which the larva feeds dies back to the first joint below the egg-chamber and drops from the vine in about six or eight weeks after the eggs are deposited. The larva changes to a pupa soon after the dead section of the cane drops.

PUPATION.

When the larva is ready to pupate it packs its burrow in two places with pellets of fiber scraped from the surrounding cane. These pellets are placed about a fourth of an inch apart at a point about mid-way between the ends of the section of cane. Within the space between the pellets the larva changes to a pupa. In about two weeks the pupa changes to the adult insect.

FULL LIFE CYCLE.

One individual was kept under close observation from egg to adult and all the changes of transformation noted. The egg was laid on May nineteenth, egg hatched May twenty-ninth, larva pupated July second, adult appeared July fourteenth. This individual was more precocious, however, than several others that were watched less closely and it can hardly be considered as a fair example with which to illustrate the life cycle of the species. The period occupied by its transformation was only fifty-six days, whereas, from sixty-five to seventy days was the average period for the transformation of the others noted. Most of the pupae change to adults early in August. The beetles remain for some time in the chambers where they have developed and then work their way out and escape. That they pass the winter in the beetle stage there is no doubt, but their place of hibernation was not found. Most likely they hide away, like the gall-maker, among fallen leaves or in rubbish.



Photographs showing adult Grapecane Girdler resting on vine and injury done to tips of canes. Natural size.

heaps, old stumps, about fences or in sheltered places in the woods.

NATURAL ENEMIES.

Reference has been made to a mite that entered the egg-chambers of the beetle when they were opened and destroyed the eggs. Specimens of this mite were collected and forwarded to Washington where they were determined as *Tyroglyphus cocciphilus* Banks, a species that has been known to feed on scale insects. I believe that this, or a similar mite, sometimes finds its way into the undisturbed egg-chambers of both the grapecane girdler and the grapecane gall-maker and destroys the eggs. I have found in fresh wounds in the canes the empty egg-shells of the beetles which had every appearance of having been attacked by the mites.

Two species of hymenopterous parasites were found attacking the larvae of the girdler as it burrowed in the cane. Both species after killing the girdler construct little cocoons within the burrow in which they transform to adult insects. One of these was identified by Crawford as *Macrodyctium sp.* The other species was not determined.

MEANS OF CONTROL.

The same measures recommended for use against the gall-maker may be adopted in dealing with this species. The injured canes are quite conspicuous early in the season and by cutting them off a few inches below the wounds and burning them the eggs and larvae may be destroyed. The insects may also be destroyed by raking together and burning all litter beneath grapevines in July, while the larvae and pupae are in the fallen canes on the ground. Spraying the vines in May and June with arsenical poisons, as is required for holding other pests of the vine in check, will most certainly destroy the beetles of this species.

